

OVERVIEW

LLNL Bioscience Research Enhances Health, Security

For nearly three decades, Lawrence Livermore National Laboratory (LLNL) has been a national focus of research in the biosciences. Today LLNL scientists from many disciplines safely conduct research in disease susceptibility, prevention, diagnosis, treatment, and rehabilitation.

Our scientists are expert in genomics (characteristics of DNA and genes), structural biology (structure and function of proteins), biomarkers (molecules that are linked to disease susceptibility), instrumentation, microbiology, biochemistry, forensic science, biological imaging, and other fields. We also leverage LLNL's world-class capabilities in physics, chemistry, engineering, and computational science. For example, we are leaders in applying supercomputers to biological research and developing ultra-compact sensors.

We partner with researchers from other Department of Energy national laboratories, federal and state agencies, University of California campuses, other universities, and several corporations on projects aimed at protecting and improving human health.

Fighting Bioterrorism

We are working with other national laboratories on ways to better detect and identify biological warfare agents in the war against terrorism.

Our scientists are developing breakthroughs in materials and technologies in the bioscience and public health fields. One example is the Hand-held Advanced Nucleic Acid Analyzer (HANAA). Weighing only two pounds and measuring 5 by 8 by 2 inches, it analyzes biological samples for DNA "signatures" that indicate specific infectious agents.

Another example is a new technology called Autonomous Pathogen Detector System (APDS) that continuously monitors air samples and automatically

reports the presence of specific biological agents.

We are using our Human Genome Project expertise to sequence several microorganisms of ecological and environmental importance. We are supporting the national need to identify infectious agents, such as a case of plague that broke out in Northern Arizona prairie dogs in early 2001.

Improving Health

Livermore scientists have been a part of the Human Genome Project since its inception. This multidisciplinary effort is now part of the DOE Joint Genome Institute, which has worked to map and sequence human chromosomes 5, 16 and 19. Collaborations with medical researchers worldwide have helped to identify the gene mutations from these chromosomes, which are responsible for a wide variety of diseases.

The National Resource for Biomedical Accelerator Mass Spectrometry was established at Livermore in 2000. With this ultra-sensitive machine, researchers from around the world are beginning to meet many challenges, from examining the way humans metabolize vitamins to developing new cancer diagnostic tests.

Several research efforts are directed at preventing, detecting, treating, and understanding the causes of cancer. For over a decade a team of researchers has been studying the relationship between cooking methods and the formation of powerful chemicals that can cause cancer. We partner with U.C. Davis medical specialists on several aspects of cancer research. We are also developing breakthrough tools to detect and treat cancer.

New Medical Technologies

Our Medical Technology Program is developing devices to improve human health and reduce health care costs. In



Lawrence Livermore human genome researcher with a DNA sample plate.

many cases we adapt technologies that were first developed for our national security mission.

For example, we adapted physics simulation capabilities to create PEREGRINE, a software program recently licensed by the Federal Drug Administration to help doctors more accurately administer radiation therapy. The Smart Probe, currently under advanced development by a corporate partner, senses indicators of breast cancer in a one-minute test using a very small needle.

These and other LLNL bioscience and health technology research efforts offer practical health benefits while contributing to homeland security.

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Bioscience and Health Research at Lawrence Livermore National Laboratory

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